

2004 RECREATIONAL USE SURVEY OF THE WEST FORK WHITE RIVER

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EXECUTIVE SUMMARY

1. Total recreational effort was an estimated 180,447 h or 2,910 h/mi. Angling accounted for the greatest amount of recreational effort (47,596 h), followed by picnicking (38,841 h), parking (27,126 h), biking (19,503 h), and boating (18,117 h). Other recreational activities, such as jogging, sightseeing, and walking, were less than 15,000 h each.
2. In general, people that used the lower portion of the river (Marion County) participated mostly in activities such as angling, picnicking, biking, and sightseeing. People that used the upper portion of the river (Hamilton and Madison Counties) participated mostly in activities such as angling, picnicking, parking, and boating.
3. Anglers in the lower portion of the river preferred to fish for black bass, catfish, and bluegill. Anglers in the upper portion of the river primarily fished for black bass (55%), while approximately 37% of the anglers did not claim a preference for any species.
4. Total estimated catch was 59,482 fish and nearly 89% of the fish were released. Smallmouth bass (33,216) accounted for over 55% of the total catch by number. Rock bass and bluegill ranked next with just over 8,800 fish each. Largemouth bass (2,365) ranked fourth in total catch, followed by channel catfish (1,921), crappie (794), and carp (784). All other species represented less than 700 fish each. Anglers harvested an estimated 6,586 fish for an overall yield of 6,038 lbs.
5. More fish were caught in the lower portion of the river (1,318 fish/mi) than in the upper portion (801 fish/mi). Nearly all (96%) the harvest by number occurred in the lower river and bluegill comprised the majority of the total harvest of all species by number. Anglers that fished in the upper river harvested only 232 fish, representing two species (bluegill and channel catfish). The majority (85%) of the largemouth bass were caught in the lower river while the majority (78%) of the rock bass were caught in the upper river. Anglers caught similar numbers of smallmouth bass between the lower (550 fish/mi) and upper river (518 fish/mi) sectors. Anglers caught relatively low numbers of other fish that IDNR stocked since the fish kill, such as flathead catfish (8 fish/mi), freshwater drum (11 fish/mi), and sauger (5 fish/mi).

EXECUTIVE SUMMARY (Cont.)

6. The estimate of localized expenditures by anglers utilizing the WFWR fishery in the current survey was intermediate to the surveys in 1989 and 2002. Anglers in the current survey made approximately 16,412 trips to the study area from April to October 2004. According to the 2001 U.S. Fish and Wildlife Survey, Indiana anglers spent an average \$37/d on total trip expenditures. Assuming that anglers only made one trip per day, anglers spent an estimated \$607,244 (\$9,794/mi) in the current survey. For comparison, anglers in Marion County spent an estimated \$19,330/mi in 2004, \$14,377/mi in 2002, and \$17,556/mi in 1989.
7. Although there were only three years of creel survey data for comparison, some general trends seemed evident. Angling pressure, yield, and expenditures (based on 2004 values) were greater before the fish kill, based on data from 1989. Angler pressure, yield, and expenditures (adjusted for inflation) increased from 2002 to 2004.

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INTRODUCTION

In December 1999, a fish kill devastated the West Fork White River (WFWR) starting at the outfall of the Anderson Waste Water Treatment Plant in Anderson, Indiana. Fish were completely removed from approximately 43 mi of river from Anderson down to the upper portion of the Broad Ripple Impoundment (Keller 2000, Ball 2002a). A partial fish kill extended another 12 miles to the Lake Indy Dam. Dead fish were collected as far downstream as the Stout Generating Plant in Marion County. An estimated 4.3 million fish weighing 180 tons were lost as a result of the 1999 fish kill (Ball 2002a). The party responsible for the fish kill was ordered to pay nearly \$14 million, of which \$6 million was for Natural Resource Damage Recovery (IDEM website). The \$6 million was used for restoration activities, such as habitat restoration, improving or acquiring public access, and restocking fish. Over 50 projects have been funded to date by the recovery money.

Recovery of the fish populations throughout the WFWR has been monitored since January 6, 2000 when initial stream surveys were conducted to assess the extent of the fish kill (Keller 2000). Since the fish kill, the Indiana DNR has completed four annual fall surveys (2001-2004) and one recreational use survey (2002). In terms of species richness, the fish community rebounded to near pre-kill levels by the fall 2002 fisheries survey. An average of 5.3 species were collected in the complete kill zone in January 2000 compared to approximately 54 species in the fall 2002 (Hoffman 2004) and 2004 surveys (IDNR unpublished data). As far as relative abundance, most species have also rebounded to pre-kill levels. Some of the increase in relative abundance of species may be due in part to intensive stocking by the IDNR. Since 2000, 13 species totaling nearly 1.15 million fish were stocked throughout the area of the WFWR affected by the fish kill (Appendix A). The IDNR stocked fish that were present in the river before the fish kill, such as channel catfish, largemouth and smallmouth bass, and bluegill. The IDNR also stocked two species (bigmouth buffalo and shorthead redhorse) that had been collected prior to the fish kill, but had not been collected after the fish kill. Sauger and freshwater drum had not been collected in fisheries surveys before the fish kill, but were assumed to inhabit the river at some time and these species were collected from the East Fork White River and stocked into the WFWR from 2002 to 2004. Restocking the WFWR after the fish kill was deemed necessary because of the extensive loss of fish and also because of numerous dams located on the WFWR that would perceivably impact recolonization (Ball 2001).

Many methods have been developed to estimate angler use and other recreational activities, but the WFWR required a design that was different from traditional access site or

roving creel surveys. There were multiple dams and low water areas along the study area that made a traditional roving creel survey difficult. There were also multiple private and public access sites that made a traditional access site creel survey impractical. A bus-route method, which is a modified access site creel survey, was chosen to estimate angler and other recreational activities. The bus-route method was developed for fisheries with multiple access sites over a large geographic area (Jones et al. 1990). An estimate of angler expenditures relating to the WFWR fishery can be calculated by using the number of trips estimated in the current survey multiplied by average expenditures per day by individual anglers, which is reported by the U.S. Fish and Wildlife Service (USFWS 2001). One creel survey was completed in 1989 on a 20-mile stretch of the WFWR that lies within Marion County (Kiley and Keller 1990), which was represented by Sector 1 in the current survey. The current study area included 62 miles of the WFWR and the objectives were to 1) estimate hours of effort for recreational activities and 2) provide estimates of angler catch and harvest from April to October 2004.

METHODS

The 62-mile study area was divided into two sectors and one creel clerk was responsible for each sector (Figure 1). Each sector was additionally divided into two sections and the creel clerk worked in one section per day. Sector 1 (19 mi) was from the 16th St. Dam to Town Run Park near 96th St., Indianapolis (Appendix B; Figure 2). Thirteen sites were established along the river in Sector 1. Sector 2 (43 mi) was from a county park near 106th St. to a canoe launch at Mounds State Park in Anderson (Figure 3). Eleven sites were established in Sector 2.

Probabilities were assigned to each site so that the total of the probabilities was equal to one for each section. Total drive time for each section was determined from previous surveys and subtracted from the 7.5 h day. The remaining time (wait time) was proportioned to each site based on its assigned probability. The season was stratified by month and kind-of-day (weekend and weekdays). A two-stage sampling design (see Pollock et al. 1994) was used to assign days (primary sampling unit, PSU) and the shift/section combination (secondary sampling unit, SSU). Clerks worked three of four weekend days and seven of ten weekdays per pay period. The starting site for each work day was randomized and the remaining sites were in consecutive order. The creel clerk would show up to the corresponding site according to the schedule, wait at each site for the allotted time, and record start and end times for each party observed. The time interval

count method (Pollock et al. 1994) was used to estimate effort and catch because a minimal number of interviews were expected. However, the time interval count method is dependent upon being able to reasonably attribute parked cars to their respective activity, which most likely was not the case in this study. Thus, effort of activities such as angling and recreational boating may have been underestimated, but temporally consistent.

RESULTS

Recreational Effort

Total recreational effort was an estimated 180,447 h (SE = 5,391) or 2,910 h/mi. Angling accounted for the greatest amount of recreational effort (47,596 h; SE = 2,432), followed by picnicking (38,841 h, SE = 1,720), parking (27,126 h; SE = 1,814), biking (19,503 h; SE = 1,720), and boating (18,117 h; SE = 1,801). Other recreational activities were less than 15,000 h (Table 1). Nearly 35% of the recreational effort occurred in May and August.

Most recreational activities differed between sectors (Table 2). Angling effort was greater in Sector 1 (28,784 h, SE = 1,889) than Sector 2 (18,812 h, SE = 1,532). Biking was also greater in Sector 1. Boating was slightly greater in Sector 2 (10,495 h, SE = 1,234) compared to Sector 1 (7,623 h, SE = 1,313). Sightseeing was over five times higher in Sector 1 (11,883 h, SE = 1,173) than in Sector 2 (2,247 h, SE = 362). Parking and walking were greater in Sector 2, while picnicking was greater in Sector 1. Jogging was similar in both sectors.

Angler effort grouped by preference differed between sectors. The exception was black bass anglers who exerted nearly identical effort between Sector 1 (10,624 h) and Sector 2 (10,417 h). Anglers fishing for black bass accounted for 37% of the effort in Sector 1, 55% in Sector 2, and over 44% for the study area. Anglers reported fishing for “anything” more often in Sector 2 (6,968 h) than in Sector 1 (235 h). Preference for bluegill fishing was almost nonexistent in Sector 2 (81 h), but was the third highest in Sector 1 (3,853 h). Effort directed towards catfish was also greater in Sector 1 (8,941 h) compared to Sector 2 (799 h). Minimal, targeted effort was reported for other species or groups of fish, such as crappie, freshwater drum, rock bass, sauger, and suckers (Tables 3 and 4).

Angler catch and harvest

Total estimated catch was 59,482 fish (SE = 1,585) and nearly 89% of the fish were released. Smallmouth bass (33,216) accounted for over 55% of the total catch by number. Rock bass and bluegill ranked next with just over 8,800 fish each. Largemouth bass (2,365) ranked fourth in total catch, followed by channel catfish (1,921), crappie (794), and carp (784). All other species represented less than 700 fish each (Table 5).

Anglers harvested an estimated 6,586 fish (106 fish/mi) and overall yield was an estimated 6,038 lbs (97 fish/mi; Table 6). More fish were caught in Sector 1 (1,318 fish/mi) than in Sector 2 (801 fish/mi). Nearly all (96%) the harvest by number occurred in Sector 1 and bluegill comprised the majority of the total harvest of all species by number. In Sector 2, anglers harvested only 232 fish, representing two species (bluegill and channel catfish). The majority (85%) of the largemouth bass were caught in Sector 1 while the majority (78%) of the rock bass were caught in Sector 2.

Only 495 smallmouth bass were harvested, which was less than 2% of the total catch of smallmouth bass (33,216). Harvested smallmouth bass measured by the creel clerks ($n = 12$) averaged 12.1 inches TL and total yield was approximately 457 lbs. The majority (75%) of the smallmouth bass released were less than 12 inches TL (Table 7). Anglers released similar numbers of smallmouth bass in Sectors 1 (550 fish/mi) and 2 (518 fish/mi). Anglers caught 0.7 smallmouth bass per hour for the season. Anglers that specifically targeted black bass averaged 2.3 smallmouth bass per hour for the season (Table 8). Average monthly, preference catch rates of smallmouth bass ranged from 1.6 to 3.7 fish/h. Preference harvest rates of smallmouth bass were minimal, ranging from 0.0 to 0.16 fish/h.

Approximately 39% (3,340) of the bluegill caught (8,853) were harvested and the majority (96%) of the harvest was in Sector 1. Anglers harvested bluegill at a mean TL of 5.0 in and yield was 379 lbs. Anglers caught 0.2 bluegill per hour for the season. Anglers targeting bluegill harvested between 0.0 and 4.4 fish/h per month and averaged 1.1 fish/h for the season.

Anglers released the majority (98%) of the rock bass and most were from Sector 2 (78%; $n = 6,851$). Anglers only harvested 185 rock bass for a total weight of 32 lbs and a mean TL of 6.0 in. No rock bass were harvested in Sector 2. Anglers reported fishing for rock bass in only two months, April and June, and they caught 8.3 and 9.5 fish/h, respectively.

Anglers caught an estimated 784 carp, of which 42% (n = 328) were harvested, all in Sector 1. Anglers harvested carp at a mean TL of 24.7 in. Carp accounted for over 37% (2,249 lbs) of the total yield.

Nearly all the largemouth bass caught were released, mostly from Sector 1. Largemouth bass greater than 14 in accounted for almost 45% of the total catch and release for largemouth bass but less than 4% of the total catch by number of all species. Largemouth bass yield totaled 22 lbs and clerks measured only two fish at 12 and 14 in TL. Anglers targeting largemouth bass caught an average 0.11 fish/h for the season, ranging from 0.07 to 0.21 fish/h.

Total catch of channel catfish was slightly higher in Sector 1 (1,107) than in Sector 2 (814). Approximately 90% of the channel catfish harvest occurred in Sector 1. Yield of channel catfish totaled 1,886 lbs, which was 31% of the total yield of all species for the season. Channel catfish were harvested at a mean TL of 16.9 inches. Anglers caught 0.04 channel catfish per hour for the season. Anglers targeting channel catfish caught an average 0.27 fish/h for the season ranging from 0.06 to 0.92 fish/h. Anglers targeting channel catfish harvested between 0.06 and 0.76 fish/h per month and 0.24 fish/h for the season.

Flathead catfish comprised approximately 10% (384 lbs) of the total yield and 3% (n = 169) of the total catch by number. Harvested flathead catfish (n = 8) averaged 16.1 in. Anglers caught an average 0.01 flathead catfish per hour for the season. Anglers that targeted flathead catfish caught between 0.0 and 0.08 fish/h per month and averaged 0.03 fish/h for the season. Anglers targeting flathead catfish harvested between 0.0 and 0.06 fish/h per month and averaged 0.02 fish/h for the season.

Approximately 40% of the crappie caught were harvested and all were from Sector 1. Only one crappie was measured (7.0 in) and yield totaled 76 lbs. Anglers harvested between 0.0 and 0.05 crappie per hour for the season. Minimal effort was directed towards crappie, so preference harvest and catch rates were not calculated.

No anglers indicated sauger as their preference, but anglers caught an estimated 280 sauger, of which 50 (18%) were harvested. Anglers caught approximately 5 fish/mi. Creel clerks measured only two fish that were both 12 in TL. Yield totaled 29 lbs.

DISCUSSION

Reliable estimates of some recreational activities were obtained from the current bus-route survey of the WFWR. In general, people that used the lower portion of the river

(Marion County) mostly participated in activities such as angling, picnicking, biking, and sightseeing. People that used the upper portion of the river (Hamilton and Madison Counties) participated in activities such as angling, picnicking, parking, and boating. Overall, angling accounted for the greatest amount of recreational effort. Surprisingly, recreational boating was greater in the upper portion of the river rather than the lower portion of the river. The lower portion had more impounded water than the upper portion, but apparently people used smaller boats and canoes in the upper river quite often.

Angler pressure and catch on the WFWR were intermediate compared to past creel surveys on similar stretches of the river. Angling pressure on the same stretch of river in 2002, just two years after the fish kill, was an estimated 533 h/mi and catch was 557 fish/mi (Ball 2005). In the current survey, pressure was an estimated 768 h/mi and catch was 959 fish/mi. Anglers caught more fish per hour in the current survey (1.25 fish/h) than in the 2002 survey (1.04 fish/mi). Both angling pressure and catch in Marion County were lower in the 2002 and 2004 surveys than in the 1989 survey. In Marion County, anglers fished less in 2004 (1,515 h/mi) and 2002 (1,282 h/mi) than in 1989 (2,742 h/mi; Kiley and Keller 1990). Yield was approximately 2.0 times greater in 1989 (625 lbs/mi) than in the current survey (307 lbs/mi; Marion County only). In the 1989 survey, carp and channel catfish represented 73% of the total yield. In the current survey, carp and channel catfish also represented the majority (68%) of the overall yield. Anglers harvested longer carp, channel catfish, and smallmouth bass in the current survey compared to the 1989 survey. However, increased mean length of harvested smallmouth bass was most likely due to the establishment of a size limit in 1998 rather than an increase in size structure of the smallmouth bass fishery since the fish kill. In contrast, anglers harvested shorter bluegill, flathead catfish, and rockbass in the current survey compared to the 1989 survey. Anglers in Marion County caught more than two times the number of smallmouth bass per hour in 2004 (0.38 fish/h) than in 1989 (0.15 fish/h). Based on comparisons among the three creel surveys on the WFWR, relative abundance of species represented in catch and harvest estimates were similar to pre-kill data. However, angler pressure and yield were lower in the 2002 and 2004 compared to pre-kill survey data in 1989.

An estimate of the localized expenditures by anglers utilizing the WFWR fishery in the current survey was intermediate to the surveys in 1989 and 2002. In the current survey, anglers spent an average 2.9 h/trip (SE = 0.12), which was calculated from 331 interviews of anglers that had completed their trips. Therefore, anglers made an estimated 16,412 trips to the study area from April to October 2004. According to the 2001 U.S. Fish and Wildlife

Survey, Indiana anglers spent an average \$37/d on total trip expenditures. Assuming that anglers only made one trip per day, anglers spent an estimated \$607,244 (\$9,794/mi) in the current survey. Anglers spent approximately \$384,097 (\$6,195/mi) during the 2002 survey (Ball 2005). In Marion County only, anglers spent an estimated \$19,330/mi in 2004, \$14,377/mi in 2002, and \$17,556/mi in 1989. Anglers spent less per mile in 1989 than in 2004, but taking inflation into account, anglers would have spent approximately \$32,497/mi in 1989 based on the number of trips they took and expenditures in 2004 dollars.

Although there were only three years of creel survey data for comparison, some general trends seemed evident. Angling pressure, yield, and expenditures (based on 2004 values) were greater in 1989 before the fish kill, but drastically declined after the fish kill. All three measures increased from 2002 to 2004. The fishery has rebounded following the fish kill in 1999, as evident from IDNR fall surveys and creel surveys. The recovery of the smallmouth bass fishery is most notable with dramatic increases in size structure and angler catch rates since the fish kill. Not many people would disagree that the 1999 fish kill affected ecosystem processes and recreational activities along the WFWR, but “how much?” and “how long?” are questions that may remain unanswered. Biologists will be better able to address these questions with continued monitoring of the fishery.

RECOMMENDATIONS

One advantage of conducting a creel survey is that the local economic impact of the fishery can be inferred from angler expenditures, which can be used to help recover resource damage money if a fish kill were a result of human actions. However, this figure does not reflect the total value of the natural resource. The total value that a person places on a trip associated with a natural resource includes, but is not limited to, aspects such as aesthetics, relaxation, and friendship (Pollock et al. 1994). Although the current study was not designed to determine total value of the fishery, it did provide an estimate of local expenditures by anglers utilizing the fishery. The WFWR fish kill was of great magnitude in terms of money recovered, compared to fish kills on other Indiana rivers (IDEM website). Total value of a fishing trip, according to economic theory, is the maximum amount an angler would pay before foregoing their trip (Pollock et al. 1994). The difference between this and the angler’s trip expenditures is called net value (or consumer surplus). Creel surveys that incorporate methods to estimate the value anglers place on a fishery can be used to potentially recover resource damages that reflect user values (Southwick and Loftus 2003), in addition to fish replacement costs and habitat damages, when a fishery is

degraded by human impact. There were two methods of estimating net value of a fishery described in Pollock et al. (1994), the contingent evaluation method and the travel cost method. Both methods have advantages and disadvantages, but either method could be included in creel surveys of Indiana waters that are prone to fish kills.

Some quantitative data on the relative effort of the different sections used in the creel survey on the WFWR was previously available (Ball 2005). Data from the current survey could be combined with data from the 2002 survey to better allocate sampling effort among the sections if a creel survey were to be duplicated in the future. Observed effort was compared with the probabilities used in the creel survey (Table 9). Probabilities in most of the sections of Sector 1 were similar to the observed effort, but there were a few section probabilities that could be adjusted. However, optimal allocation could be used to sample the sections based on the proportion of the variance that each section contributed to the total variance of the sector (Table 9). Thus, if a section had a large variance, it should be sampled more often in the next survey, therefore, reducing overall variance and increasing precision. Station 6 of Sector 1 is a good example. Approximately 91% of the overall variance in Sector 1 was attributable to Station 6. The difference between observed effort and probabilities used for each section was greater in Sector 2. Changes could be made in future surveys to better reflect the amount of effort in different areas of the WFWR.

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Table 1. Estimated effort (h) of recreational activities from a bus-route, recreational use survey on the West Fork White River, 2004.

| Activity | April | May | June | July | August | Sept. | Oct. | Season total | SE |
|-------------|-------|-------|-------|-------|--------|-------|-------|--------------|-------|
| Angling | 5,342 | 8,502 | 5,816 | 7,266 | 8,982 | 6,487 | 5,200 | 47,596 | 2,432 |
| Biking | 4,693 | 3,659 | 2,219 | 1,955 | 1,919 | 2,701 | 2,358 | 19,503 | 1,720 |
| Boating | 2,561 | 3,970 | 2,511 | 2,920 | 2,193 | 2,507 | 1,455 | 18,117 | 1,801 |
| Jogging | 1,296 | 628 | 350 | 399 | 319 | 340 | 468 | 3,800 | 1,168 |
| Parking | 1,947 | 4,180 | 4,626 | 4,944 | 3,166 | 4,338 | 3,925 | 27,126 | 1,814 |
| Picnicking | 3,023 | 8,530 | 5,223 | 2,996 | 9,191 | 4,684 | 5,194 | 38,841 | 1,720 |
| Sightseeing | 2,539 | 2,927 | 1,963 | 1,564 | 1,916 | 2,038 | 1,183 | 14,130 | 1,228 |
| Walking | 1,675 | 1,828 | 2,126 | 1,399 | 926 | 1,983 | 1,397 | 11,333 | 811 |
| | | | | | | | Total | 180,447 | 5,391 |

Table 2. Estimated total effort (h) and standard errors of different user groups from a bus-route, recreational use survey of the West Fork White River, 2004.

| Activity | Sector 1 | | | Sector 2 | | |
|-------------|------------|-------|---------------|------------|-------|---------------|
| | Effort (h) | SE | Effort (h/mi) | Effort (h) | SE | Effort (h/mi) |
| Angling | 28,784 | 1,889 | 1,515 | 18,812 | 1,532 | 437 |
| Biking | 16,838 | 1,685 | 886 | 2,665 | 346 | 62 |
| Boating | 7,623 | 1,313 | 401 | 10,495 | 1,234 | 244 |
| Jogging | 2,416 | 1,109 | 127 | 1,384 | 365 | 32 |
| Parking | 11,763 | 1,434 | 619 | 15,363 | 1111 | 357 |
| Picnicking | 22,257 | 905 | 1,171 | 16,584 | 1,463 | 386 |
| Sightseeing | 11,883 | 1,173 | 625 | 2,247 | 362 | 52 |
| Walking | 3,546 | 538 | 187 | 7,787 | 607 | 181 |

Table 3. Estimated effort (h) of angler preference groups from a bus-route, recreational use survey for Sector 1 of the West Fork White River, 2004.

Table 5. Estimated harvest and catch per species from a bus-route, recreational use survey on the West Fork White River, 2004.

| Common name | <u>Sector 1</u> | | <u>Sector 2</u> | | Season Total |
|--------------------|-----------------|----------|-----------------|----------|--------------|
| | Harvested | Released | Harvested | Released | |
| Bluegill | 3,296 | 3,254 | 134 | 2,169 | 8,853 |
| Buffalo | 76 | 15 | 0 | 0 | 91 |
| Carp | 328 | 292 | 0 | 164 | 784 |
| Channel catfish | 890 | 217 | 98 | 716 | 1,921 |
| Crappie | 119 | 184 | 0 | 491 | 794 |
| Flathead catfish | 169 | 151 | 0 | 184 | 504 |
| Freshwater drum | 626 | 15 | 0 | 61 | 702 |
| Largemouth bass | 19 | 1,988 | 0 | 358 | 2,365 |
| Morone spp. | 83 | 260 | 0 | 266 | 609 |
| Other ¹ | NA | 0 | NA | 308 | 308 |
| Rock bass | 185 | 1,786 | 0 | 6,851 | 8,822 |
| Sauger | 50 | 46 | 0 | 184 | 280 |
| Smallmouth bass | 495 | 10,447 | 0 | 22,274 | 33,216 |
| Spotted bass | 0 | 31 | 0 | 0 | 31 |
| Suckers | 18 | 0 | 0 | 184 | 202 |
| Totals | 6,354 | 18,686 | 232 | 34,210 | 59,482 |

¹ Comprised of green sunfish, warmouth, and yellow perch.

Table 6. Estimated number and weight of fish harvested by sport anglers from a bus-route, recreational use survey of the West Fork White River, 2004. The length frequency distribution of the fish measured by the creel clerk (n) was expanded by the total estimated harvest by species per inch group. The intercept and slope was used to calculate weight per inch group.

| Common name | n | Mean TL (in) | Estimated harvest | % Total harvest | Estimated yield (lbs) | % Total yield |
|----------------------|----|--------------|-------------------|-----------------|-----------------------|---------------|
| Bluegill | 89 | 5.0 | 3,430 | 52.1 | 379 | 6.3 |
| Buffalo ¹ | 8 | 14.0 | 76 | 1.1 | 113 | 1.9 |
| Carp | 12 | 24.7 | 328 | 5.0 | 2,249 | 37.2 |
| Channel catfish | 44 | 16.9 | 988 | 15.0 | 1,886 | 31.2 |
| Crappie ² | 1 | 7.0 | 119 | 1.8 | 20 | 0.3 |
| Flathead catfish | 8 | 16.1 | 169 | 2.6 | 387 | 6.4 |
| Freshwater drum | 14 | 10.9 | 626 | 9.5 | 408 | 6.8 |
| Largemouth bass | 2 | 13.0 | 19 | 0.3 | 22 | 0.4 |
| Morone sp. | 3 | 6.3 | 83 | 1.2 | 11 | 0.2 |
| Rock bass | 7 | 6.0 | 185 | 2.8 | 32 | 0.5 |
| Sauger | 2 | 12.0 | 50 | 0.8 | 29 | 0.5 |
| Smallmouth bass | 12 | 12.1 | 495 | 7.5 | 457 | 7.6 |
| Suckers ³ | 1 | 18.0 | 18 | 0.3 | 45 | 0.7 |
| Totals | | | 6,586 | | 6,038 | |

¹ Length-weight regression was for smallmouth buffalo

² Length-weight regression was for black crappie

³ Length-weight regression was for quillback

Table 7. Catch-and-release estimates of different size groups of largemouth bass and smallmouth bass from a bus-route, recreational use survey of the West Fork White River, 2004.

| Common name | Size class (in) | Sector 1 | Sector 2 | Total |
|-----------------|-----------------|----------|----------|--------|
| Largemouth bass | < 14 | 1,017 | 252 | 1,269 |
| | > 14 | 917 | 106 | 1,023 |
| Smallmouth bass | < 12 | 7,669 | 16,837 | 24,506 |
| | > 12 | 2,788 | 5,437 | 8,225 |

Table 8. Mean preference harvest and catch rates (fish/h) for anglers that were interviewed during a bus-route, recreational use survey on the West Fork White River, 2004.

| Species or group | April | May | June | July | August | Sept. | Oct. | Season |
|------------------|-------|------|------|------|--------|-------|------|--------|
| <u>Catch</u> | | | | | | | | |
| Channel catfish | 0.06 | 0.12 | 0.50 | 0.17 | 0.10 | 0.92 | 0.07 | 0.27 |
| Flathead catfish | 0.00 | 0.00 | 0.02 | 0.08 | 0.01 | 0.07 | 0.00 | 0.03 |
| Largemouth bass | 0.08 | 0.07 | 0.17 | 0.21 | 0.07 | 0.09 | 0.16 | 0.11 |
| Rock bass | 9.50 | . | 8.33 | . | . | . | . | 9.11 |
| Smallmouth bass | 1.23 | 2.02 | 2.11 | 1.56 | 3.71 | 2.07 | 2.55 | 2.32 |
| <u>Harvest</u> | | | | | | | | |
| Bluegill | 0.00 | 4.44 | 0.00 | 1.37 | 0.15 | 2.38 | 0.00 | 1.07 |
| Channel catfish | 0.06 | 0.12 | 0.46 | 0.13 | 0.08 | 0.76 | 0.07 | 0.24 |
| Flathead catfish | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.05 | 0.00 | 0.02 |
| Rock bass | 0.00 | . | 0.00 | . | . | . | . | 0.00 |
| Smallmouth bass | 0.06 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.16 | 0.03 |

Table 9. Probabilities used for each section during the creel survey along with the observed proportion of total effort per section and variance each site contributed to the overall variance per section for a bus-route, recreational use survey of the West Fork White River, 2004.

| Section | Station | Probability used | Proportion of total effort | Proportion of total variance |
|-----------------|---------|------------------|----------------------------|------------------------------|
| <u>Sector 1</u> | | | | |
| 1 | 1 | 0.21 | 0.18 | 0.01 |
| | 2 | 0.25 | 0.25 | 0.02 |
| | 3 | 0.08 | 0.08 | 0.02 |
| | 4 | 0.32 | 0.18 | 0.04 |
| | 5 | 0.11 | 0.03 | 0.01 |
| | 6 | 0.04 | 0.27 | 0.91 |
| 2 | 7 | 0.08 | 0.06 | 0.20 |
| | 8 | 0.11 | 0.11 | 0.10 |
| | 9 | 0.09 | 0.14 | 0.04 |
| | 10 | 0.16 | 0.18 | 0.07 |
| | 11 | 0.29 | 0.25 | 0.48 |
| | 12 | 0.13 | 0.09 | 0.04 |
| | 13 | 0.14 | 0.17 | 0.07 |
| <u>Sector 2</u> | | | | |
| 1 | 1 | 0.33 | 0.12 | 0.03 |
| | 2 | 0.10 | 0.21 | 0.13 |
| | 3 | 0.03 | 0.30 | 0.49 |
| | 4 | 0.36 | 0.10 | 0.02 |
| | 5 | 0.07 | 0.15 | 0.13 |
| | 6 | 0.11 | 0.12 | 0.20 |
| 2 | 7 | 0.07 | 0.26 | 0.25 |
| | 8 | 0.36 | 0.25 | 0.25 |
| | 9 | 0.04 | 0.25 | 0.20 |
| | 10 | 0.27 | 0.14 | 0.18 |
| | 11 | 0.25 | 0.09 | 0.12 |

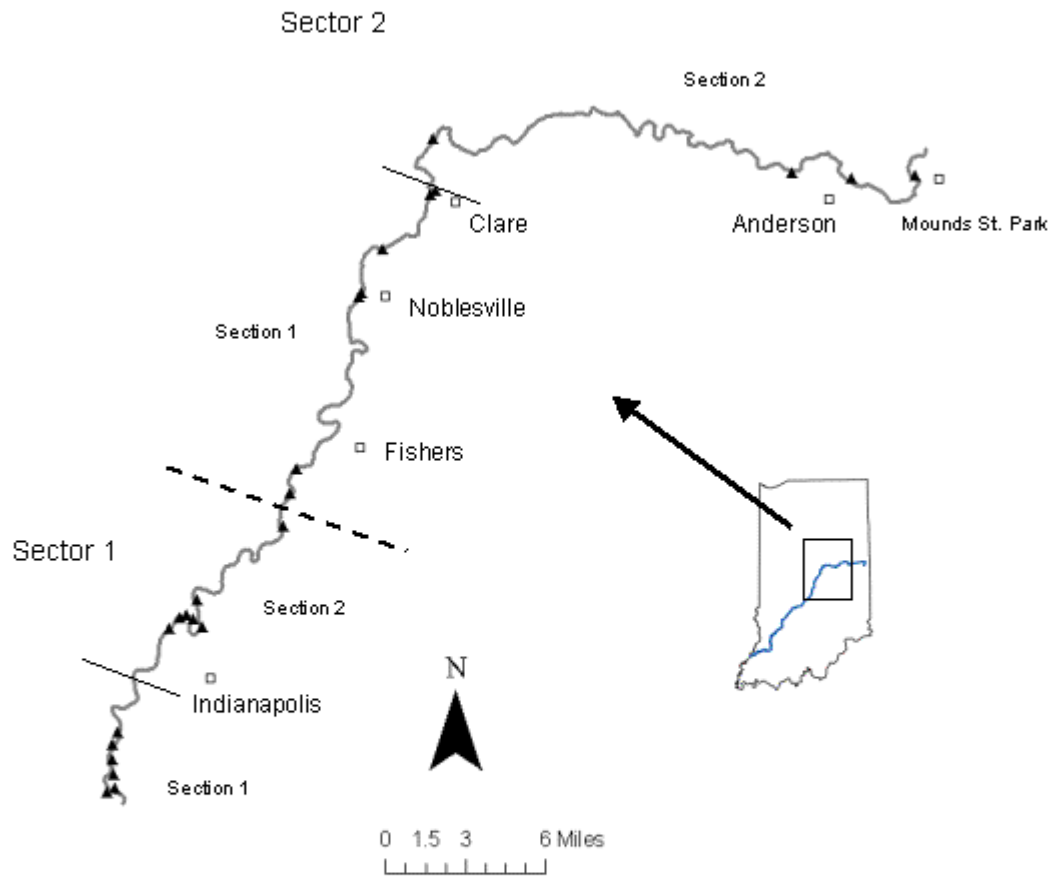


Figure 1. Bus-route sites for a recreational use survey of the West Fork White River, 2004. The study area was divided into two sectors, each of which was additionally divided into two sections.

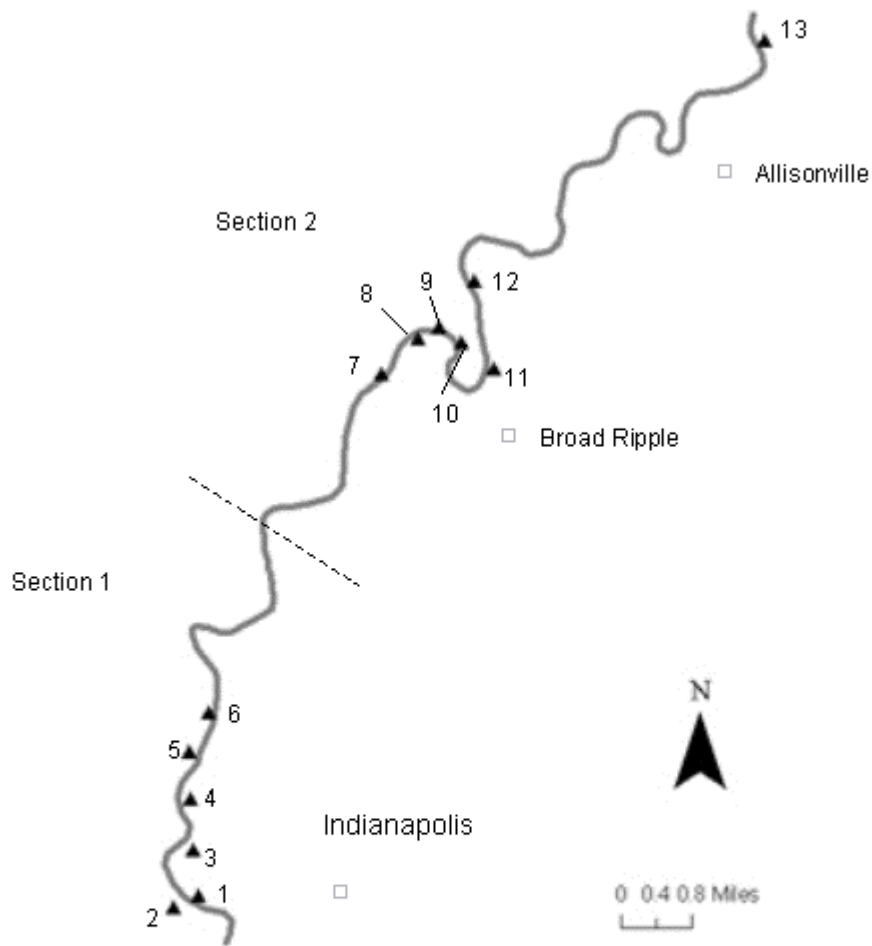


Figure 2. Sector 1 sites for a bus-route, recreational use survey of the West Fork White River, 2004.

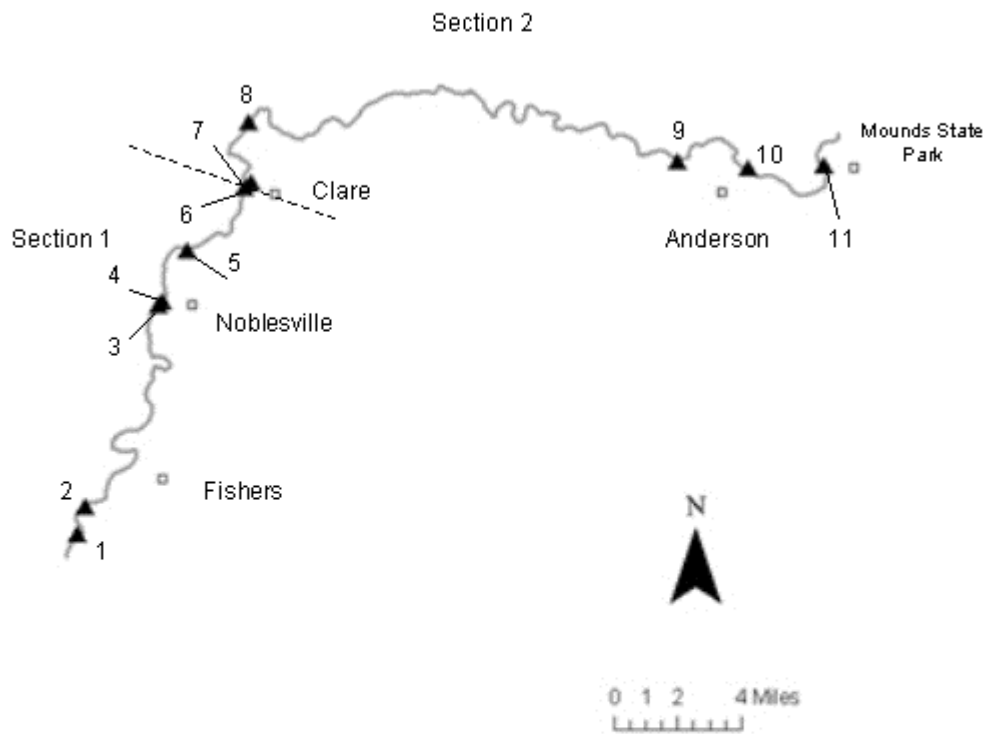


Figure 3. Sector 2 sites for a bus-route, recreational use survey of the West Fork White River, 2004.

Appendix A . Summary of the number of species stocked in the West Fork White River since the fish kill in 1999.

| Common name | 2000 | 2001 | 2002 | 2003 | 2004 |
|----------------------|---------|--------|---------|---------|-----------|
| Bigmouth buffalo | - | - | 34 | 29 | 28 |
| Bluegill | 204,743 | - | - | - | - |
| Black crappie | - | 10 | - | - | - |
| Channel catfish | 202,304 | 57,748 | 68,377 | - | - |
| Crappie ¹ | 108 | 18 | - | - | - |
| Flathead catfish | 111 | 961 | 1,280 | - | - |
| Freshwater drum | - | - | 139 | 67 | 68 |
| Largemouth bass | 79,887 | 31,051 | 13,050 | - | - |
| Rock bass | 22,176 | 9,800 | 9,697 | - | - |
| Redear sunfish | 23 | - | - | - | - |
| Sauger | - | - | 49,395 | 12,549 | 32,304 |
| Sauger (fry) | - | - | 149,650 | 139,400 | - |
| Smallmouth bass | 32,626 | 22,074 | 3,771 | - | - |
| Shorthead redhorse | - | - | 86 | 102 | 83 |
| White crappie | 3,820 | - | - | - | - |
| | | | | Total | 1,147,569 |

¹ No distinction between how many black or white crappie were stocked.

Appendix B. Sections and stations used in a bus-route, recreational use survey on the West Fork White River, 2004. Probabilities add up to approximately one for each section.

| Section | Site | Site Name | Location / comment | Probability used |
|-----------------|------|--------------------------|---------------------------|------------------|
| <u>Sector 1</u> | | | | |
| 1 | 1 | 16 th St. Dam | East side of river | 0.21 |
| | 2 | 16 th St. Dam | West side of river | 0.25 |
| | 3 | Riverside Park | Parking area | 0.08 |
| | 4 | Riverside Park | Boat ramp | 0.32 |
| | 5 | 30 th St. | Restaurant and bridge | 0.11 |
| | 6 | I-65 Overpass | Access under overpass | 0.04 |
| 2 | 7 | Holliday Park | Handicap ramp | 0.08 |
| | 8 | College Ave. Bridge | Downstream of bridge | 0.11 |
| | 9 | Marott Park | Canoe portage | 0.09 |
| | 10 | Westfield overflow | Access from Westfield Dr. | 0.16 |
| | 11 | Broad Ripple | Boat ramp and park | 0.29 |
| | 12 | 73 rd St. | The Beach (Ravenswood) | 0.13 |
| | 13 | 96 th St. | Town Run Park | 0.14 |
| <u>Sector 2</u> | | | | |
| 1 | 1 | 106 th St. | County park | 0.33 |
| | 2 | 116 th St. | City Boat Ramp | 0.10 |
| | 3 | Schwarz's Bait Shop | Concrete fishing pier | 0.03 |
| | 4 | Public Boat Ramp | DNR owned | 0.36 |
| | 5 | Potters Bridge | County park | 0.07 |
| | 6 | Riverwood Boat Ramp | Includes Clare Dam | 0.11 |
| 2 | 7 | Riverbend Campground | Private boat ramp | 0.07 |
| | 8 | White River Campground | Private campground | 0.36 |
| | 9 | Raible Ave. Bridge | Canoe launching site | 0.04 |
| | 10 | Edgewater Park | City park | 0.27 |
| | 11 | Mounds State Park | Canoe launch and wading | 0.25 |

Appendix C. Proportion of observed effort and catch for each section and sector in a bus-route, recreational use survey of the West Fork White River, 2004.
Proportions add up to one for each sector.

| Section | Station | Proportion of effort | Estimated effort (h) | Proportion of catch | Estimated catch (n) |
|-----------------|---------|----------------------|----------------------|---------------------|---------------------|
| <u>Sector 1</u> | | | | | |
| 1 | 1 | 0.08 | 2,372 | 0.09 | 2,298 |
| | 2 | 0.11 | 3,268 | 0.14 | 3,484 |
| | 3 | 0.04 | 1,052 | 0.02 | 426 |
| | 4 | 0.08 | 2,282 | 0.13 | 3,373 |
| | 5 | 0.02 | 446 | 0.00 | 93 |
| 2 | 6 | 0.12 | 3,551 | 0.02 | 593 |
| | 7 | 0.03 | 963 | 0.04 | 1,075 |
| | 8 | 0.06 | 1,677 | 0.05 | 1,186 |
| | 9 | 0.08 | 2,220 | 0.03 | 686 |
| | 10 | 0.10 | 2,891 | 0.09 | 2,206 |
| | 11 | 0.14 | 3,931 | 0.21 | 5,356 |
| | 12 | 0.05 | 1,496 | 0.00 | 111 |
| | 13 | 0.09 | 2,637 | 0.17 | 4,152 |
| <u>Sector 2</u> | | | | | |
| 1 | 1 | 0.09 | 1,611 | 0.12 | 4,159 |
| | 2 | 0.15 | 2,855 | 0.17 | 6,013 |
| | 3 | 0.21 | 3,957 | 0.05 | 1,887 |
| | 4 | 0.07 | 1,377 | 0.28 | 9,805 |
| | 5 | 0.11 | 2,011 | 0.02 | 568 |
| | 6 | 0.08 | 1,555 | 0.05 | 1,654 |
| 2 | 7 | 0.08 | 1,442 | 0.04 | 1,269 |
| | 8 | 0.07 | 1,355 | 0.08 | 2,589 |
| | 9 | 0.07 | 1,383 | 0.03 | 935 |
| | 10 | 0.04 | 766 | 0.11 | 3,725 |
| | 11 | 0.03 | 498 | 0.05 | 1,837 |